BT300CP
Lead-Free Reflow Oven

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v2.3
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1 Safety

- Install an air switch with creepage protection. Failure to do so may result in electric shock, personal injury or fire.
- Ground the connection pole for the plug of the power supply firmly. Failure to do so may lead to electric shock, damage to the oven components, or fire.
- If there is something wrong with the machine, disconnect the power supply immediately. Determine the cause of and eliminate the fault, then restart the machine.
- Do not put hands into the fan blades.
- Do not disassemble the machine.
- The cooling vents must not be blocked. Nothing should be laid on the enclosure.
2 BT300 Series Features & Specifications

2.1 Features

- Sample leaded and lead-free solder profiles included.
- Suitable for leaded and lead-free solders.
- PCB holder measures 9.05" x 14.57" (230 mm x 370 mm).
- Soldering time is approx. 6 minutes (dependent on paste), plus cool-down.
- Quick heat-up: three minute warm-up time.
- Easy operation: place the PCB on the holder, close the drawer, press RUN.
- PID temperature controls for ±2°C accuracy.
- Reproduce solder paste manufacture recommended profiling curves by specifying up to 40 sequential temperature setpoints with PC connection and included software.
- Attach a thermocouple to the PCB being processed to view, save and print hard copies of real-time thermal profiling data (PC required).
- Analyze temperature graphs post-reflow with point-and-click temperature comparison (PC required, not included).
- Create and store a full library of profiles (PC required, not included).
- Comprehensive spare parts kit included.

2.2 Specifications

<table>
<thead>
<tr>
<th>Applicable Solder Types</th>
<th>Lead-Free and Leaded</th>
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<tr>
<td>Table Size</td>
<td>9.05&quot; x 14.57&quot; (230 mm x 370 mm)</td>
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<tr>
<td>Heating Method</td>
<td>Quartz IR &amp; Forced Hot Air Convection</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>Ambient - 300 °C</td>
</tr>
<tr>
<td>Temperature Control Method</td>
<td>PID Control; ±2% SSR</td>
</tr>
<tr>
<td>Temp Control Setting</td>
<td>20-40 Time/Temperature Segments per Profile</td>
</tr>
<tr>
<td>Warm-up Time</td>
<td>approx. 2 min.</td>
</tr>
<tr>
<td>Exhaust Requirement</td>
<td>6.3 L/Min., .22 CFM</td>
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<tr>
<td>PC Interface</td>
<td>Windows®-based profile management software included, PC optional (not required for operation)</td>
</tr>
<tr>
<td>Electrical</td>
<td>220 V, Single Phase, 50/60 Hz, 15A</td>
</tr>
<tr>
<td>Power</td>
<td>1.7 KW; 4.1 KW (max.)</td>
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</table>
Dimensions
26.38" L x 21.26" W x 11.81" H
(670 mm L x 540 mm W x 300 mm H)

Weight
approx. 100 lbs. (45 Kg)
3 Machine Structure

- RS232 communication interface
- Cooling vent for convection motor
- Power On/Off
- 25A fuse
- 5A fuse
- Power supply
- Nitrogen hose connector (BT300NC only)
- Cooling fan
- ID tag
- Microcontroller
- Temperature Controller
- Run button
- Thermocouple port
4 Installation

After unpacking, check the machine for damage that may have occurred during shipping. Check the contents against the packing list. If anything is missing or damaged, please contact Manncorp.

4.1 Location

- Place the oven on a sturdy, flat surface.
- Operate the oven in a clean, dry work environment away from liquids, flammables and corrosive materials.
- Leave enough space around the oven for operating, maintenance and repair.

4.2 Environmental Conditions

Operating temperature: 0–38˚C
Operating humidity: 85% RH and below
Storage temperature: -10–60˚C
Storage humidity: 85% RH and below
Altitude: 2000 m and below

4.3 Oven Hardware Installation

- A 20A breaker should be installed between the machine and power supply.
- The power supply of the reflow soldering machine should be 220 VAC (±10%) single phase with ground (PE) with the rated power of 3.5 kw and above.
- The protective earth (PE) could also serve as the static resistance ground wire, but the grounding resistance must meet the related requirement.
- The power supply plug must connect with the socket with a rated current of 25A and above.
- The machine should be placed on a stable working desk. In the case of a steel working desk, the desk should be grounded to prevent static charges.
• Make sure that no wires have come loose during transportation.
• Clean the oven of dust or dirt.
• Double check that the ground wire is connected correctly. If the oven is not grounded, the operator could be in danger of an electrical shock if there is a power leakage.

4.4 Software Installation

1. Insert the CD in your Windows computer’s CD drive.
2. If installation does not start automatically, browse the CD and double-click on the installation file: BT300NCP+V6.0+setup.exe.
3. On the welcome screen, click Next to begin.

4. You can use the default directory (recommended) or specify a different directory for the software to be installed in. Click Next to continue installation.
5. The installation will create a shortcut for the oven software in the Start Menu folder. Click Next to continue.

6. It will also create a shortcut icon on the desktop unless you uncheck the selection. Click Next to continue installation.
7. The installation wizard has all the information it needs to install the software. Click "Install" to continue. You will see the progress of the installation.

8. Once the files are installed, click Finish. The Reflow Soldering Control program will start automatically unless you uncheck that option.
Completing the Reflow Soldering Control System Setup Wizard

Setup has finished installing Reflow Soldering Control System on your computer. The application may be launched by selecting the installed icon.

Click Finish to exit Setup.

[Box with option to Launch Reflow Soldering Control System]

Finish
5 Quick-Start Guide

5.1 Operation Notes and Cautions

- Temperature profiles cannot be set or reset while the soldering machine is running.
- The PCB to be soldered should not be bigger than the effective solder area of 270 x 230 mm.
- Put the PCB flat in the drawer.
- Do not leave the oven unattended during operation.
- Don’t touch the thermocouple probe.
- Let the oven cool to below 50˚C before turning the oven's power off.

5.2 Machine Startup

1. Confirm that the power supply matches the power of the oven.
2. Verify that the ground is firmly attached.
3. Clean the inside of the machine.
4. Connect the computer to the oven through a COM port. If your computer does not have an RS232 port, see Section 10 to install the USB to RS232 Converter on your computer.
5. Press the power supply switch on the reflow oven. After the controller initializes, the [PV] window displays the present temperature inside the reflow oven (red character) and the [SV] window shows the set value.
6. Turn on the computer and start the oven software.

5.3 Running Production

1. On the computer, go to Meter Settings and open the profile you want to run.
2. Press the Drawer In/Out switch to open the drawer.
3. Place the PCB on the board holder and press the button again to close the drawer.
4. Press the Connect button and then the RUN button to start the soldering cycle using the selected profile. The [SV] window displays the set temperature and the [PV] window displays the current temperature in the oven.

5. At the end of the cooling cycle, the drawer will open automatically. The board will still be hot, so you should wear protective gloves to remove the board or let the board sit in the drawer until it further cools off.

6. After removing the board, let the oven cool down before you load the next board. Once cooled, put the next board in and start the cycle again.

**NOTE:** If you do not let the oven cool down, the profile for the next board will be different and could result in solder defects.
6 Oven Operation

**IMPORTANT:** Due to the combination of IR and convection air, the temperature on the PCB is usually higher than the temperature measured by the thermocouple inside the oven. So the [PV] (present value) window will display a temperature that might be 10–30°C lower than the temperature of the PCB. Please refer to the recommended settings for lead-based and lead-free solder paste. These settings were tested with an average sized PCB with a 1.6 mm thickness.

6.1 Software Setup

1. After installing the software on the computer (see Section 3.4), connect the computer to the oven through the COM port.

2. Open the Reflow Soldering Control System software and go to Settings → COM Settings and choose the COM port you have connected the oven to.

![Software Setup](image)

6.2 The Login Screen

1. Open the Reflow Soldering Control System software on the computer.
2. Choose the type of oven you have (BT300CP standard model or BT300NCP nitrogen model)

3. The user name and password are filled in automatically.

4. The default value for the User is manncorp

5. The default value for the Password is Manncorp

6. Click the [OK] button to enter the main control menu.
6.3 Creating Users

1. Go to the Settings menu and choose User Settings.

2. In the User Settings menu, you will see a list of users. Here you can create, modify or delete users.

3. To create a new user, click the Create button.
1. Type the new user name.
2. Choose the user level. 1 is the highest level; 3 is the lowest.
3. Put in a password of up to 6 characters and confirm the password.
4. Press OK.

**NOTE:** The new user will now show in the User Setting list until you press the Refresh button.

### 6.4 Modifying a User

You can modify an existing user by clicking the Modify button. In the Modify User window, you can select the user you want to modify and press the >> button. Now you can modify all the values of that user. Press the Modify button to accept the changes and close the window.

![Modify User Window]

On the User Setting screen you will not see the changes until you press the refresh button.

### 6.5 Creating, Changing & Loading Profiles

Two sample profiles—one for lead and one for lead-free—are included at the end of this manual. It is recommended you start with these.

#### 6.5.1 Access the Temperature and Time Setting Window

1. To create, change or load a profile, first make sure that the oven is disconnected. The Disconnect button should be pressed in as in the picture below:
2. Then press the Meter Settings button on the main screen. The Temperature and Time Setting window will open.

### 6.5.2 Create a New Profile

1. In the Temperature and Time Setting Window, you can create a new profile by typing in the temperature and time values for up to 40 segments in one profile. If you do not want to use all 40 segments, set the temperature and time of the remaining segments to 0 (zero).
2. Press the AutoCount button to calculate the time when the cooling fan will turn on. The value will automatically be put in the ALT section.
3. Use the Save button to save the profile.

Below is a sample profile that uses all 40 segments for a lead-free profile. Segments 1 to 35 have been used for heating and 36-40 for cooling.
6.5.3 Sending a Profile to the Oven

1. To load a new profile into the oven, open the Temperature and Time Setting Screen for that profile. (If you need to load a different profile into the screen, click the Open button.)
2. Click the Connect button (you may have to click it twice) to connect to the oven.
3. Press the Write button to send the data to the oven. You can see the transfer progress in the changing colors of each temperature and time setting.

6.6 Parameter Settings

The parameters are set at the factory and should not be changed, except the ALT setting, which is automatically calculated when you press the AutoCount button.

Below is a short description of the parameters.

**AL1** The total operation time of the cooling fans (default: 568 seconds)

**AL2** Alarm duration time (default: 22 seconds)

**SEC** Time difference between AL1 and AL2 (default is 0)
**ALT**  Time from program startup to the AL1 startup point, which will turn on the cooling fan. The time is calculated by clicking the AutoCount button. For example, if the T35 is the maximal temperature of the profile, then it begins to cool at T36, so the formula created by ALT is \( t_1 + t_2 + t_3 + \ldots + t_{35} - 3 \) (seconds).

**SC**  Sensor temperature offset. The default is zero and we advise against changing it.

**PID**  Temperature control data. This is relative to the temperature control accuracy. The default values are 9, 100 and 60. We advise not to change them.

The relationship between AL1, AL2, SEC and ALT is as follows:

After changing the parameter settings, you need to write the settings to the controller by clicking the Set button in the control section of the screen.

After you’ve changed the settings and transferred (written) them to the oven, please return to the main menu by clicking the OK Return button.

### 6.7 Analyzing the Profile

1. Click Online.
2. Put a PCB in the oven.
3. Click Start to begin the profile. (You may have to click Start twice.)
4. At this time, the oven starts to increase its temperature according to the settings, and the computer creates a temperature graph. After the temperature graph is created, you can analyze the curve by clicking the Analyze button.
5. Choose any two points on the graph with the mouse to display the temperature of each point and the slope between.
6.8 Recording Actual Board Temperatures

Due to the combination of IR and convection air, the temperature on the PCB is usually higher than the temperature measured by the thermocouple inside the oven, so the “Actual Temperature” window will display a temperature that is about 10–30°C lower than the temperature on the PCB.

To create a good profile, an external profiler or its built-in profiler should be used with thermocouples attached directly to the PCB. This way, the profile can be matched with the recommended profile of the solder paste manufacturer.

The BT300 series ovens allow you to attach a thermocouple to the PCB and record the actual temperature of the board. To monitor actual PCB temps, in the temperature graph drop-down menu, select Actual Curve.

If you want to monitor the temperature of the heaters, choose Temperature Curve from the drop-down menu. This will record the temperature of the heaters inside the oven.

Typical reflow profile for leaded solder paste.
### 6.9 Things to Take Into Account When Setting a Temperature Profile

- Set the temperatures first according to the temperature profile of the solder being used. Different types of solders have different metal contents and different recommended temperature profiles, so the reflow soldering temperature profile for a product should be set according to the temperature profile given by the solder manufacturer.
- Account for the material, thickness and size of the PCB, and whether it is multilayer or not.
- Account for the density, size and color of the components to be mounted, as well as whether there are any special components, such as BGAs, CSPs, etc.
- The heating system of the soldering machine is a quick heating system. Differences exist between the practical temperature and the displayed temperature.
7 Maintenance & Troubleshooting

7.1 Daily Maintenance

7.1.1 Power Line Check
Check the connection of the plug before starting the machine. There should be no looseness.

7.1.2 Cleaning
After the machine has cooled, wipe the inside and outside. Do not use strong, caustic cleansers. The inside can be wiped with alcohol.

7.2 Thermocouple Probe
The thermocouple probe lies at the top of the quartz heating tube on the cover of the machine. It should not be struck while working. It should be periodically wiped with absolute alcohol to remove dirt that could interfere with its operation.

7.3 Troubleshooting

7.3.1 Heating Fault
If the solder paste does not melt after a complete soldering process with a normal temperature profile, one of the quartz heating tubes might be bad. Check by turning on the power and observing the tubes to see if they light up. Replace any bad tubes using quartz heating tubes made by the original manufacturer.

NOTE: Tube replacement should be done only by service personnel and with the machine disconnected from the power; otherwise personal injury and/or damage to the device may occur.

7.3.1.1 Replacing a Quartz Heating Tube
NOTE: a) The body of the machine must be cool before attempting to replace a heating tube. b) Use a fixing spanner to prevent damage to the porcelain insulation parts.
1. Keep the machine running to observe the heating tubes. The one that is not lighting up is the one that is bad.
2. Stop the machine and turn off the power supply.
3. After the machine is cool, lift the cover and remove the fixed screws.
4. Turn over the heating unit and dismantle the holder of the heating tubes.
5. Screw off the porcelain caps on both ends of the tube and loosen the nuts.
6. Remove the quartz heating tube from the block spring and replace it with a new one.
7. Reverse the steps and return the oven to its upright position.
8. Let the cover down and watch carefully to make sure everything is in order.

7.3.2 No Display or Fan Does Not Operate
Check that the power is switched on. If power is normal but there are still faults, contact Manncorp.

7.3.3 Abnormal Sounds from the Fan
Turn off the power supply and lift the cover. Check to see if the fan blades are touching the body of the machine. If so, adjust the position of the fan blades and tighten the fan.

7.3.4 Peculiar Smell During Operation
Check the temperature setting. If it is too high, it can cause carbonation of the PCB. Check for foreign matter, such as paper, impurities, grease, dirt, etc.
8 Recommended Profile Settings

The default temperature and time settings have been stored in the microprocessor controller and the control software. The easiest way to produce a profile is to fine-tune the times and temperatures in the default profile.

8.1 Sample Lead Profile

This is a sample profile for lead solders and does not guarantee that it is suitable for your PCB and solder paste. Use this as a starting point for your lead-solder profile.

<table>
<thead>
<tr>
<th>Number</th>
<th>Temperature</th>
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<th>Temperature</th>
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8.2 Sample Lead-Free Profile

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9 Appendix: USB to RS232 Converter

Many modern computers do not come with an RS232 port. Use the USB to RS232 Converter to convert a USB port into an RS232 port for connection to the oven. Following are instructions for installing the converter driver on Win 2000, XP and Vista (Section 10.1) and Windows 7.0 (Section 10.2).

9.1 Installing the converter on Win 2000, XP and Vista computers

1. Power on your computer and make sure that the USB port is enabled and working properly.
   **IMPORTANT:** Do not plug in the USB2.0 to RS232 converter until the software installation is complete.

2. Insert the installation CD and open the folder with the driver. It will be located in USB 2.0 TO RS232 Converter\driver\win2000_xp-vista_x86x64

3. Double-click the file CDM20814_Setup.exe. It will open the following interface:

![Image](image)

The system will automatically install the driver.
4. After the installation is finished, connect the USB 2.0 to RS232 converter to the computer's USB port. The computer will detect a new USB serial port.

5. The new hardware will be automatically installed. When installation is complete, you will see the following message:

6. Right-click "My Computer" and choose "Properties."
7. The System Properties window will open. Click the "Hardware" tab and select "Device Manager."

8. All of the devices installed on your computer will be displayed. Please refer to the following chart to see how to find the COM port number that your new port was installed at. Please take note of the COM port number that the new serial port was installed to. You will need to select this COM port in the oven software.

```
- Human Interface Devices
- IDE ATA/ATAPI controllers
- Keyboards
- Mice and other pointing devices
- Other devices
- Ports (COM & LPT)
  - Communications Port (COM1)
  - Communications Port (COM2)
  - Printer Port (LPT1)
  - Virtual COM Port (COM3)
- Processors
- Sound, video and game controllers
- System devices
- Universal Serial Bus controllers
  - Standard Universal PCI to USB Host Controller
  - Standard Universal PCI to USB Host Controller
  - Standard Universal PCI to USB Host Controller
  - Standard Universal PCI to USB Host Controller
  - USB Root Hub
  - USB Root Hub
  - USB Root Hub
  - USB Root Hub
  - USB Serial Converter
```
NOTE: If "USB Serial Port (COM3)" (or other COM number) doesn't show up under "Ports (COM & LPT)" please refer to Section 10.3, Troubleshooting the USB Serial Converter.

9.2 Installing the converter on Windows 7.0

1. Power on your computer and make sure that the USB port is enabled and working properly.

   **IMPORTANT:** Do not plug in the USB2.0 to RS232 converter until the software installation is complete.

2. Insert the installation CD and open the folder with the driver. It will be located in

   USB 2.0 TO RS232 Converter\driver\windows 7.0

3. Right-click the file CDM20814_Setup.exe and choose "Run as Administrator."

4. When installation has finished, a completion screen is displayed:

   ![Completion Screen](image)

5. Now plug the USB2.0 to RS232 converter into the computer's USB port. Windows will detect the new hardware and install the driver automatically.

6. Once the hardware is installed, press the Windows Start button to bring up the Start menu. Select "Control Panel."

7. From the Control Panel window, select Hardware and Sound.
8. On the Hardware and Sound screen, select Device Manager. (It's one of the links under Devices and Printers.)

9. You will see USB Serial Converter and, under "Ports (COM & LPT)," the USB Serial Port with a COM number. Please take note of the COM port number (for example: COM3).

You will need to select this COM port in the oven software.

NOTE: If "USB Serial Port (COM3)" (or other COM number) doesn't show up under "Ports (COM & LPT)" please refer to Section 10.3, Troubleshooting the USB Serial Converter.

9.3 Troubleshooting the USB Serial Converter

If, after installation, you can see "USB Serial Converter" in the Device Manager but can't see, under "Ports (COM & LPT)" the "USB Serial Port (COM#)" (where # is the number of the COM port the converter has been assigned to):
1. Right-click on "USB Serial Converter" in the Device Manager and select "Properties."
2. The USB Serial Converter Properties window will open. Click the "Advanced" tab and select "LoadVCP." Click OK.

![USB Serial Converter Properties](image)

3. Remove the USB to RS232 converter from your computer and plug it in again. Check the Device Manager to see if the USB Serial Port appears under Ports (COM & LPT).